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March 1991

THE MAC FLYER - For Greater Safety in MAC Air Operations

Delivering the sting . . . page 16

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17 ZERO HOUR!

This is it! The deadline is almost here. The contest ends precisely on the stroke of midnight, 31 March 1991, and you can make it if you hustle.

All who enter will receive a one-year free subscription to *TMF*. If selected as one of the 12 winners, you'll see your name in print and receive an engraved plaque for all to admire. You have a golden opportunity to boost your ego and, at the same time, contribute something to safe flight operations. Your entry may be based on fact, fiction, or fantasy; expressed in prose or poetry, with either a technical, philosophical, or humourous angle.

We need your story. ✯

THE RULES

The 1991 MAC Flight Safety Writing Contest is conducted according to MACR 900-3 and these rules. Entries must be original, unpublished, contain an aviation safety/mishap prevention message, and be postmarked no later than 31 March 1991. Stories must be between approximately 1,000 and 3,000 words long (about 6 to 14 double-spaced types pages). Poetry should average 75 to 100 lines. Manuscripts must be typed, double-spaced, and submitted in two copies. Identify entries by title only and attach a cover sheet indicating author's name, address, duty phone, unit, and home address. Please include a brief biography.

The contest is open to all. Entries qualifying under the above rules earn their author a complimentary one-year subscription to *TMF*. However, desk sets and plaques may only be awarded to military members and civilian employees of the Department of the Air Force and Air Reserve Components. Other entries may be selected for Honorable Mention Special Category.

Winning entries will be published in *TMF*.

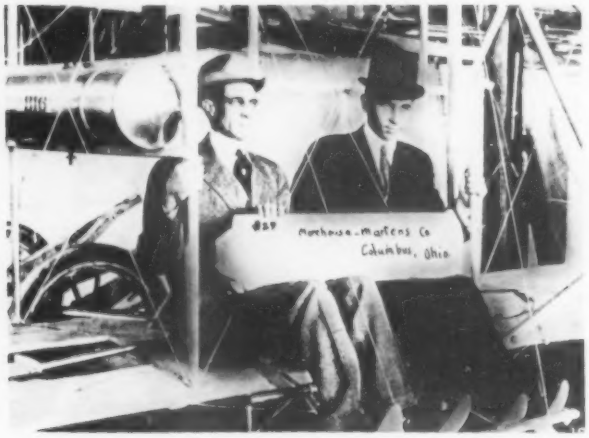
Submit to:

MAC Flight Safety Writing Contest, 1991
HQ MAC/QSSE
Scott AFB, Illinois 62225-5101

Souls United

By MSgt. Clyde H. Beal
130 CAM Sq

"Safety in the past, present, and future . . . ."



From Kitty Hawk, I touched the moon
My knowledge knows no end
My story tells of progress
With a team of many men

My logic shares a premise
Which history proves me true
That I must be included
In the heart of every crew

For safety taken lightly
Is a battle never won
Is a masquerade of progress
Is a mission never done

If by now I have you asking
Then perhaps you don't believe
That safety has a heart and soul
That I truly live and breathe

You must credit me my wisdom
And give credence to my past
For my story starts so long ago
And I'm sure you know my cast

I flew with Billy Mitchell
Caused Rickenbacker's fame
Knew the Flying Tiger squadron
And called them each by name

Like you, they had their briefings
Their concerns along life's way
And their thoughts of flying safety
Were much like yours today

In Berlin, I carried food and coal
As a team, we got things done
Back then I was important
Today I'm still the one

HONORABLE MENTION
1990 MAC FLIGHT SAFETY WRITING CONTEST

I made Enola Gay immortal
Kept the Mustang flying high
I made a flight of Thunderbirds
So graceful I would cry

I flew a thousand Herkeys
Took Ole Shakey's maiden flight
Flew Yeager through the sonic boom
Credit me when it's done right

I am the walk of gemini
I've raised a satellite
I'm Friendship Seven, Eagle One
A moon trip landing light

I'm a checklist with a message
Where every word has purpose
When part one is overlooked
It will likely later surface

I'm a safety message banner
With words that need repeated
I'm a proper load of cargo
I'm a thought that's always needed

For I know too well what happens
When I'm not understood
How things become distorted
Like you thought they never would

I pardon few who tempt me
Their fame not my concern
I only hope they hear me well
I always hope they learn

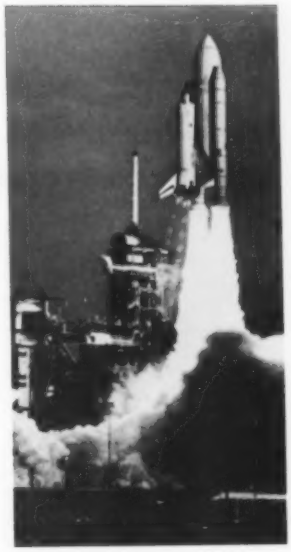
I'm the attitude for teamwork
Whose members share one goal
One mission undivided
For the sake of every soul

I'm challenge never ending
Helping safety rule each flight
Forget me, laws are broken
Keep me near you, things go right

I'm a drop of blood that matters
An airman filled with pride
A mission just returning
With all my sons inside

I'm more than just a reason
I'm more than just a part
More than just a goal to reach
I am the very heart

Next time you hear of safety
Give the message all it's due
Pay attention — listen closely
The best of *life* I offer you



MSgt. Clyde H. Beal, another faithful contributor to the MAC Flight Safety Writing Contest, is a graduate of Marshall University and a member of the West Virginia ANG, Charleston, W. Va.

Excellence in Airmanship

Left to Right: Capt. William P. Isler, Jr., Maj. James K. Garvin, Capt. Brent H. Mills, SSgt. Patrick M. McClennan. Not pictured A1C. Bernard C. Hunke.

Maj. James K. Garvin and Crew, 62d Tactical Airlift Squadron, Little Rock AFB, Ark., were on an RTU tactical training mission, 24 Aug 1990. The C-130 crew consisted of instructors and unqualified copilot and navigator students. The crew was performing a formation low approach to Little Rock when the student copilot, attempting to complete the "After Takeoff Checklist," encountered a nose landing gear "in-transit" indication with the main landing gear indicating "up and locked." The crew maneuvered the aircraft clear of the formation and climbed to a safe altitude to troubleshoot the malfunction. Attempting to return the nose landing gear to a "down and locked" condition, the student copilot returned the landing gear control handle to the "down" position. The main gear extended normally but the nose landing gear remained "in-transit." The flight engineer visually checked the nose gear and found it in the "in-transit" position. Dash One emergency hydraulic extension and manual extension (free fall) procedures were performed to no avail.

Additional attempts were made to lower the nose gear by maneuvering the aircraft using positive and negative g's with and without hydraulic pressure. The nose gear still failed to extend fully. Further in-flight technical assistance was initiated through a Conference Skyhook with standardization/evaluation, maintenance, and Lockheed Aeronautical Systems representatives. All subsequent attempts to lower the nose gear were unsuccessful. The crew consulted the Dash One for procedures for landing with the nose gear retracted and main gear down. The crew depleted the aircraft's oxygen supply to bare minimum since the liquid oxygen bottle is located in the nose wheel well and would be a possible source for an aircraft explosion and fire. The aircraft commander also elected to jettison excess fuel not needed for landing. With 10,000 pounds of fuel remaining, the crew was confronted with a rapidly approaching thunderstorm and its associated wind gusts, forcing them into an immediate landing.

Preparing for an efficient and rapid egress, all nonessential flight deck and cargo compartment crewmembers were relocated near

the paratroop doors, and the student copilot was replaced by a newly-assigned instructor pilot. With all options considered, the AC flew the distressed C-130 to a soft touchdown, lowering the nose gently onto the runway prior to losing elevator control, using rudder and differential power to maintain centerline. The aircraft skidded approximately 2,000 feet to a stop and the crew egressed safely.

The professional insight and actions of Major Garvin and crew prevented a potential disaster. They are most deserving of the MAC Excellence in Airmanship Award. *TMF* congratulates them.

Capts. Kenneth B. Domenick and Joseph L. Helmer, 1400 MAS, Norton AFB, Calif., were on a C-12 airlift mission in support of Operation DESERT SHIELD, 8 Sep 1990. They were on the next to last leg of the mission, inbound to McGuire AFB, N.J., with three passengers and high priority MICAP parts. Approach Control instructed the crew to maintain high airspeed during the approach due to following traffic. To comply with these instructions, the crew delayed configuration until five miles from the runway. At five miles, they selected approach flaps and lowered the gear handle. During the "Before Landing" checks, they identified an unsafe left main gear indication which was accompanied by a red light in the gear handle. The crew tested the gear indicator light and determined it to be operable.

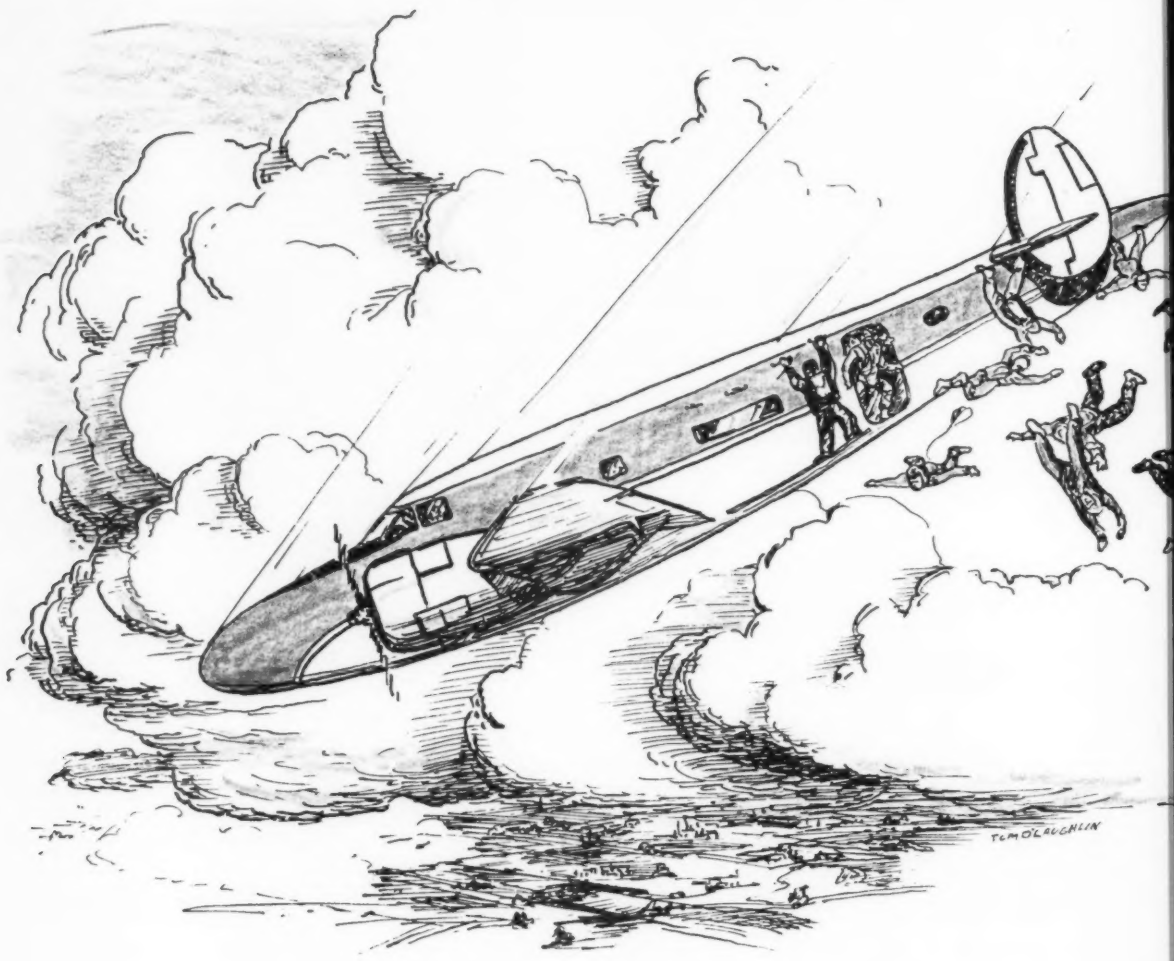
They informed Tower of the problem and a subsequent "fly-by" revealed the gear appeared down. They discontinued the approach and returned to Approach Control to troubleshoot the problem. Once established in a safe radar pattern, the crew accomplished the appropriate emergency checklists. Their manual gear extension attempt was unsuccessful. The crew retracted the gear to conserve fuel and continued to troubleshoot. The gear raised normally. They attempted to lower it again, but received the same unsafe indications on the left main gear.

The crew initiated a Conference Skyhook through the wing Command Post to review all options. Experts suggested they check for other indications. The red light was on in the gear handle and the "gear warning" horn sounded as power was reduced. Abrupt pitch and yaw movements did not change cockpit indications. All efforts to obtain a safe "gear down and locked" indication were exhausted, and the crew decided to land with full flaps and partial gear down in accordance with Dash One procedures. After terminating the phone patch, the crew briefed their plan of action for the landing and roll-out and briefed passengers on correct procedures for crash landing and use of exits. The AC elected to fly a long, flat visual approach to decrease the initial touchdown speed. He touched down smoothly 1,500 feet down the runway and on the right side since the left landing gear was considered unsafe. As the aircraft slowed, the left gear began to collapse. To decrease the possibility of an engine fire, the crew immediately shut down engines by feathering both propellers and selecting condition levers to fuel cut-off. The aircraft stopped about 4,000 feet down the 10,000-foot runway and 20 feet from the runway's left edge. The crew completed shutdown procedures and performed an orderly emergency egress.

Capt. Kenneth B. Domenick

Capt. Joseph L. Helmer

A gear malfunction is the nightmare of every aviator. Captains Domenick and Helmer methodically exhausted every available means to ensure passenger and aircraft safety. Their calm attitude and professional performance prevented a possible loss of life and a valuable aircraft. They well deserve the MAC Excellence in Airmanship Award. Congratulations from *TMF*.



Out of Limits and Out of Control

When jumpers put an aircraft beyond limits.

FLIGHT HISTORY

About 1810 PDT on 21 August 1983, a Lockheed L-18 Learstar, N116CA, operated by Landry Aviation, Inc., as a sport parachute jump flight, departed the Arlington, Wash., municipal airport for its fourth drop of the day. The aircraft was carrying

jumpers to a drop zone near Silvana, Wash., about five nautical miles west of the airport. The jump plan called for the flight to carry 24 parachutists to 12,500 feet MSL where they would make a mass jump. The aircraft was not equipped with seats; instead it had 24 seatbelts, in two rows of 12, attached to seat track/cargo tiedown rails in the floor. The aft cabin entry door had been removed. For takeoff, the jumpers sat on the floor in rows three abreast, facing aft. One jumper occupied a jump seat immediately behind the cockpit.

Surviving parachutists stated that takeoff and climb to altitude were normal. All parachutists remained in the positions occupied for takeoff until reaching jump altitude. Survivors also stated none of the jumpers seated on the floor used available seatbelts. About one minute before the airplane arrived over the drop zone, two jumpers moved aft to the door to spot for the run-in and relay hand signal maneuvering directions to the pilots. As the airplane neared the drop zone, the jumpers moved to their prejump positions. Two jumpers moved outside the door; one forward of the door on a narrow external step holding on to an external handle and one on the aft side of the doorway holding on to the aft door frame. A third positioned himself in the doorway by standing on the door sill, facing inboard and holding onto the top door frame. Additional jumpers lined up as close as possible to the door. The other 16 lined up in rows of eight, along both sides of the cabin.

The jumpers stationed in the door were not aware of any airplane problems as they jumped. One of them observed the airplane after he fell away. It was in a steep dive during which it made one or two slow spirals before striking the ground. Descriptions of the descent by several other jumpers were similar.

Three jumpers, the ninth, 11th, and 12th in the planned jump sequence, felt the aft end of the airplane drop, then oscillate slightly up and down. The airplane then rolled to the right before the jumpers were able to reach the door. Sixteen of 24 jumpers were able to exit the airplane before and after the sequence began. One was killed and two seriously injured; 13 were uninjured. All 16 parachutes functioned normally.

Witnesses on the ground, many of whom had watched previous flights that day, stated that as the first jumper left the airplane, it rolled to the right, entered a steep dive, and rotated slowly two or three times during the dive. They said it struck the ground in a steep nosedown attitude slightly past vertical. They described loud "screaming" engine sounds which continued until the airplane struck the ground. Some witnesses described a light-colored smoke trail coming from one of the engines during the later part of the dive.

The airplane struck the embankment of State Highway 530 with the nose about 10 to 15 degrees past vertical. Except for some small light pieces, the wreckage was confined to the impact crater which measured about 15 feet across. The wings were positioned at the opposite sides of the crater, and both engines were buried about six feet into the earth.

The two seriously injured jumpers left the airplane after it had rolled and begun its descent. They both struck the horizontal stabilizer after exit but were able to open their parachutes; both suffered leg injuries.

The fatally injured jumper was observed by other jumpers to have descended in a properly opened parachute. His injuries were consistent with severe impact to the lower back. The ten persons unable to leave the airplane were killed by impact forces.

ANALYSIS

There was no evidence to indicate that the pilots calculated weight and balance for the loading condition of this particular flight. Another pilot, who had flown most of the flights since parachute operations began, stated that before beginning such operations he had performed general weight and balance calculations for loads of 16, 18, 20, 22, and 24 jumpers. Those calulations were based on a weight distribution which assumed the jumpers were seated for takeoff and assumed that at higher loads 12 jumpers would sit in the forward-most area of the fuselage designated as compartment A. The five loading compartments, A through F, are simply sections of the fuselage designated by painted lines on the cabin wall.

Calculations showed that in order to keep the center of gravity within the aft limit, two jumpers would have to occupy the compartment immediatedly behind the cockpit, 12 would have to occupy the forward-most cabin compartment, and the remainder would occupy the two compartments designated B and C.

Interior photographs of N116CA loaded for takeoff, which were made about two weeks before this accident, show only six jumpers seated in the

forward compartment. That compartment was 56.75 inches long. The next three compartments aft were 35.5 inches long. Using an average front-to-back body depth of ten inches and ten inches for the thickness of the parachute pack, investigators estimated weight and balance for the takeoff with 24 jumpers. The estimate indicated the jumpers would have to occupy space back to compartment D. This calculation resulted in an estimated center of gravity location at takeoff of 205.3 inches aft of the datum. The aft limit is 198.8 inches.

The pilot who performed the takeoff weight and balance calculations also stated neither he nor the other pilots had made any calculations for the load configuration of 24 jumpers positioned for a mass jump with eight jumpers gathered at the door and on the outside step. Investigators estimated weight and balance based on the airplane configuration described by the survivors.

All jumpers participating on the day of the accident had filed "experienced jumper waiver and information" forms on which they entered their weight. These weights and the typical weights of parachutes and equipment were used by the Safety Board to determine the airplane weight and balance with jumpers in jump position. The location of each jumper was described by the jump coordinator who had assigned each a specific place in the jump sequence. This information and the body dimensions from the cited reference were used to estimate the placement of each jumper in the cabin. The fuel on board was estimated based on the number of flights since last refueling and the typical fuel consumption of previous jump flights. Using this information, the Safety Board calculated a jump configuration center of gravity location of 214.5 inches aft of the datum.

During investigation of this accident, the Safety Board learned of at least four other instances in which Lockheed L-18 airplanes entered steep nosedown descents while on jump runs with 24 or more jumpers on board. Pilots involved in these occurrences were interviewed. Their accounts were similar to those given by survivors and witnesses of the accident. The pilots stated that when the jumpers moved aft and gathered at the doorway, an increasing amount of forward elevator was required to maintain level attitude until full or nearly full nosedown elevator was applied. As power was reduced and airspeed slowed, their elevator would no longer control the pitchup. All pilots reported that the tail dropped and the airplane rolled over entering a steep, nosedown descent. One of the pilots described a fully developed spin which he stopped with standard spin recovery procedures. All pilots were able to recover after a significant altitude loss. The recovery technique was to add power, apply rudder against the roll and, with the nose down and airspeed increasing, reduce power and recover from the dive. All said their experiences caused them to revise their jump run procedures.

In the previous incidents, the pilots were able to recover after a large altitude loss. In this instance, however, the pilot did not recover. Witness descriptions of the sounds indicate the engines were probably at high power. The pilot may have increased power in an attempt to add airspeed and fly out of the stall. If power was not reduced, it would result in rapid acceleration and high airspeed in the dive. At high speeds with the elevator trim nearly full nosedown, pilot inputs required to overcome the high control forces were probably beyond the physical capabilities of the crew. Although the Safety Board could not state with certainty why the appropriate power and trim changes were not made to assist recovery, one likely reason is the intrusion into the cockpit area by one or more jumpers who could have fallen into the area during the rolls or subsequent dive. If this did take place, the pilots could have been prevented from taking action to recover from the dive.

PROBABLE CAUSE

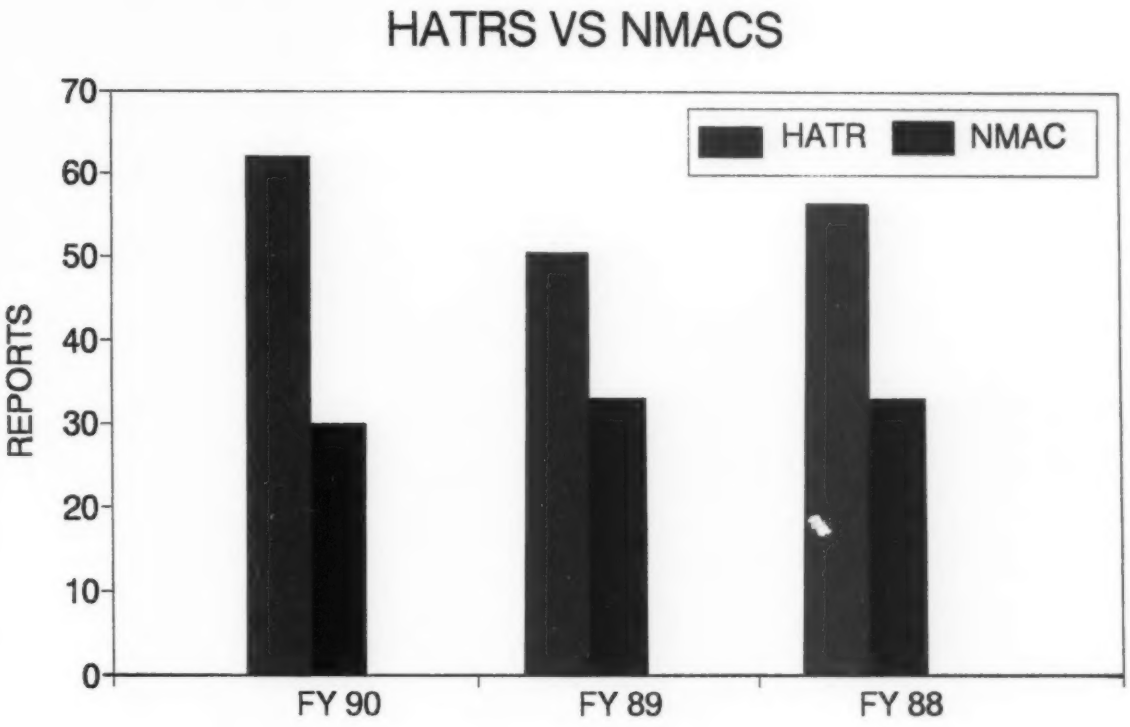
The National Transportation Safety Board determined the probable cause of this mishap to be failure of the operator, and the pilot-in-command to assure proper load distribution during jumper exit. The Safety Board also believed accomplishment of several successful flights with critical center of gravity conditions may have influenced operator and pilot thinking. If the takeoff could be made, any problem which may occur during the jump procedure could be safely resolved because the altitude and mobility of the jumpers provided an adequate margin for recovery.

APPLICATION TO MAC

The pilots in this mishap probably knew they were not going by the book, but they had gotten away with it before, so why shouldn't they get away with it again?

Regulations and operating restrictions are established to protect people and equipment. No matter how well thought-out the guidelines are, they have no value when ignored. You may be able to "twist the tiger's tail" once or twice, but living dangerously can become a habit. You can be certain that the time will come when you will find out why the rule was written.

Adapted from: *NTSB/AAR-84/06*



Hazardous Air Traffic Reports

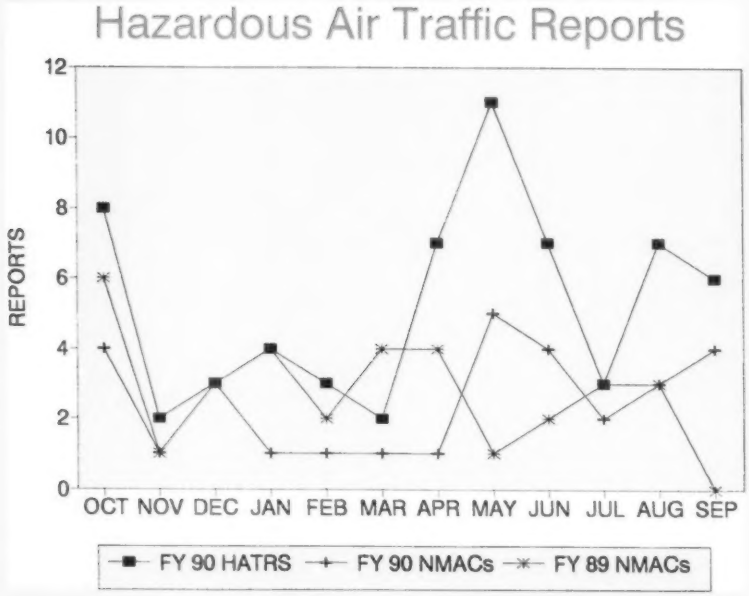
Where the near midair collisions were in 1990.

By Maj. Stephen E. Behr
Associate Editor

A MAC aircraft climbing in night visual conditions on an IFR flight plan is involved in a collision with another aircraft cleared for a VFR local flight from a nearby airfield. Flaming wreckage rains down on the residents of a medium-sized city.

You think it can't happen—but it did. It was 1 February 1958. A MATS C-118 took off from Runway 30 at Long Beach Municipal Airport, Calif., for McGuire AFB, N.J. The C-118 was on an IFR flight plan, cleared to an en route cruising altitude of 17,000 feet. The climb to cruising altitude was planned using visual flight rules. At an approximate altitude of 500 feet, the C-118 requested and was cleared for a right turn out of traffic. Continuing to climb on an easterly course, it collided about five minutes after takeoff with a Navy P2V level at 2,500 feet on a northerly heading. The P2V was on a local night VFR familiarization and instrument training flight. Both pilots failed to give way to the other aircraft; they failed to "see-and-avoid" on a clear night over Norwalk, California.

I know what you're thinking—we've come a long way since then—it couldn't happen today. A September 1990 near midair collision (NMAC) between a C-5 and a Boeing 747 points out that, indeed, it could happen again. The aircraft passed within 50 to 100 feet of each other while cruising at FL 370, over a VOR, in controlled



airspace. The C-5 was reported to be on a VFR flight plan (illegal? obviously), while the Boeing was on an IFR flight plan. Both aircraft were established on airways that crossed at the VOR. Both aircraft reported passing the VOR within the same minute.

Yes, aircraft systems have improved. ATC systems have improved (in some areas), but in many cases, our missions still operate in areas of poor communications with overworked air traffic controllers. You haven't improved either.

Your eyes haven't evolved or improved as aircraft speeds have increased and technology advanced. Nor do we take into account the number of aircraft operating today. You still depend on your eyes to provide most of the basic input necessary for performing flight—attitude, speed, direction, and proximity to things (like the ground) and aircraft that may constitute a danger of in-flight collision.

There are some steps you can take to decrease your chance of a near or midair collision.

— Prioritize scanning and eliminate non-essential duties and tasks during arrival and departure. You can generally avoid the threat of an in-flight collision by scanning the area 60 degrees to the left and right of your center visual area and 10 degrees up and down from your flight path.

— Minimize flight time below 5,000 feet AGL by delaying descent and expediting climb. During fiscal 1990, 74 percent of NMACs reported in MAC occurred below 5,000 feet AGL.

— Listen for potential traffic conflicts during ATC transmissions. For oceanic flights or flights in areas with known radio problems, it means monitoring the ATC frequency before you get to a Flight Information Region/ Upper Flight Information Region (FIR/UIR). Accurate communications are essential when operating in congested airspace; don't use slang or jargon terms.

— Reduce airspeed during arrival and departure to decrease closure speeds and increase reaction time. It can take as long as 12.5 seconds to see another aircraft, recognize it, become aware of collision potential, decide to turn, and account for aircraft response time to control inputs.

— Don't rely solely on ATC traffic advisories to call out conflicting traffic; not all aircraft appear on radar (or have transponders) and ATC issues traffic advisories on a work load permitting basis. A collision with a glider or ultra-light aircraft not shown on radar is still deadly.

— Use landing and taxi lights, even during daylight, to increase visibility of your aircraft. Use of all available external lighting is an AFR 60-16 requirement.

— Be particularly vigilant when operating near TCAs, TRSAs, ATAs, and bases which conduct training. Of 19 NMACs reported by MAC aircraft in the CONUS for FY90, eight were from two MAC bases which conduct intensive training. NMACs frequently occur at the borders of designated airspace where some VFR airmen cruise. They fly at boundary altitudes or within a few hundred feet of them, or fly tracks which are planned to pass as close as within one-eighth mile of the lateral boundaries—they are legal but not safe.

Sometimes we are our own worst enemy. Eight of the HATR incident reports listed another MAC aircraft as being the other aircraft involved.

When it comes to "see-and-avoid" in increasingly busy airspace, collision avoidance still depends on your vision and your ability to recognize collision potential. During the winter months, low visibility and ceilings challenge us to sustain a higher level of situational awareness. As the gray overcast gives way to better flying conditions, there is a tendency to relax one's vigilance at a time when the "fair weather" flyers are just getting back into the sky.

Active and Focused Monitoring:

Identifying a Problem Before It Finds You

By Dr. Charlotte Freeman, Associate Professor of Psychology Samford University

Awareness is the salient aspect of effectively controlling our environment. This is because our actions (behavior) are largely dependent upon the information we choose to select and monitor. This article addresses active and focused monitoring as a process to selectively focus attention on the most important aspects of the flight environment.

ACTIVE AND FOCUSED MONITORING

Operationally, active monitoring can be defined as the process of continually interrogating selective and relevant sources of information to detect and identify early indications of potential problems. Focused monitoring is the process of continually interrogating a particular system or factor to search for any change in the existing status.

The concept of active and focused monitoring, shown in Figure 1, is simply to find the problem and take corrective action before it escalates and finds you. Think of this flow chart as having three loops. The first, shown in the upper left, occurs when everything is normal and only active monitoring is needed. If an anomaly is discovered, the loop expands to include both active and focused monitoring. And finally, the captain is brought into the loop whenever a safety problem is identified.

ACTIVE VS. PASSIVE MONITORING

It is important to understand the differences between active and passive monitoring. Passive monitoring is indirectly attending to stimuli by conditioned, involuntary, reflexive responses, i.e., driving your car while thinking about other things. Under these conditions you will only be pulled back to the primary task when stimuli of an alarming and/or distracting nature intervene: i.e., lights, horns, certain types of signs, emergency situations, etc.

Active monitoring, on the other hand, is consciously and selectively attending to the primary task, i.e., driving your car while thinking about the

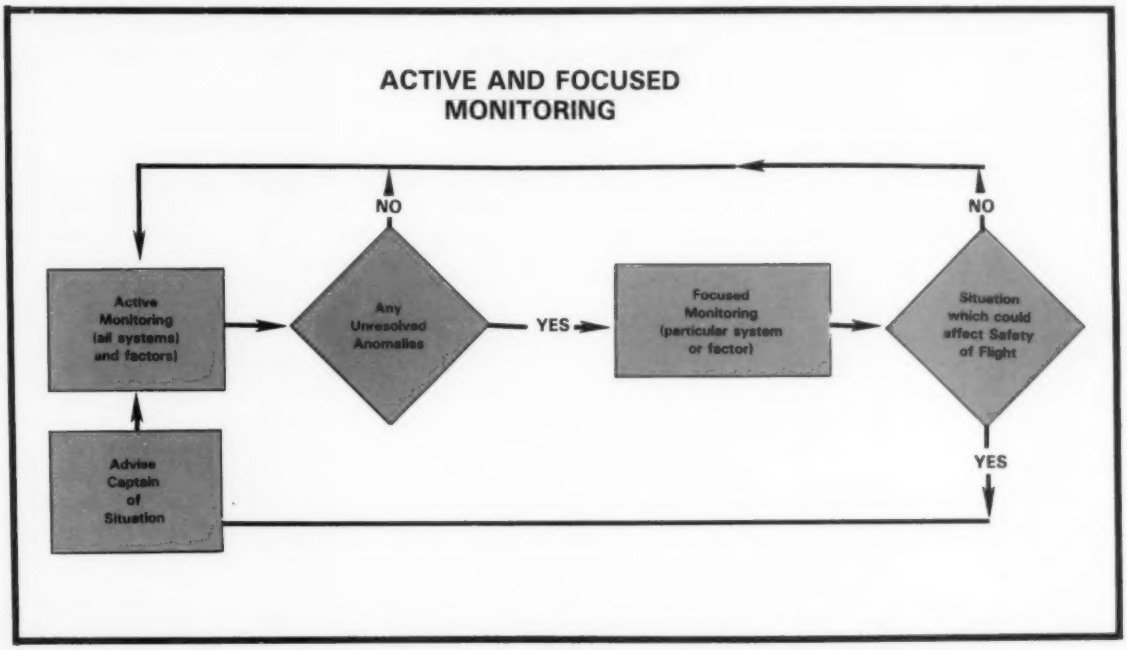


Figure 1

driving environment. It requires commitment, energy, and effort. This can best be achieved through development of a mindset which recognizes the importance and technique of active monitoring. The improvement in awareness, however, will be significant. Imagine what the highway safety record would be if everyone kept their "minds on the road" and drove defensively by actively monitoring the highway environment.

SELECTIVE ATTENTION

The monitoring must be selective, since no one can possibly monitor everything. Attempting to rapidly scan a large volume of information will not be effective because scanning is basically a non-selective process which can easily result in sensory overload. The reason for this is that we are bombarded by literally millions of environmental stimuli every second, but our sensory registers and short-term memory can only process a small amount of this information. The key element of monitoring, therefore, is to identify and select the appropriate items so that our attention is focused on the most critical areas.

SELECTION OF ITEMS TO MONITOR

Each occupation must identify the appropriate items to be monitored. Thus, we would expect requirements to be different for a soldier on patrol behind enemy lines, a policeman responding to an armed robbery call, a surgeon performing a major operation, a bus driver, a railroad engineer, a ship's captain, or an airline pilot. These occupations are all concerned with active monitoring and awareness but the specific items to be monitored will vary significantly. While we can all identify some of the items which each occupation monitors, only those within the particular profession will have the necessary experience to develop a comprehensive list. Clearly, it's the responsibility of those in charge of the training of each occupation to identify areas for selective attention and strategies and skills to facilitate that effort. The following general areas should be considered:

1. Awareness of risk areas.
2. Awareness of attack strategies and techniques.
3. Awareness of environmental signals.

To illustrate the application of the three general areas, consider some of the awareness areas you would like to monitor if you were taking your family on a hike in the woods. Wouldn't you want to be aware of risk areas like the presence of poisonous snakes, bears, dangerous terrain, etc.—strategies and techniques to deal with the above risks—environmental signals, like the sound of a rattler, to warn you of impending danger? Now, let's apply these concepts to the field of aviation.

RISK AREAS

As previously stated, each occupation must develop its own list of risk areas and heightened consciousness awareness. Once a risk is perceived, behavior will change in much the same way people will walk differently when they are aware that poisonous snakes may be in the area.

The risk areas should be quite specific so the identification of a particular risk will trigger a change in behavior. Risk areas such as "the takeoff/landing phase of flight" or "communications" are too general. On the other hand, a "runway incursion" is very specific and can be tied to specific behavior to prevent the incursion. It is likely that risk areas will be different in two-person vs. three-person crews and in glass vs. conventional instrumentation. Risks are also dynamic and must be constantly updated to meet the needs of the changing environment. Thus, new risks will probably be identified at the introduction of each new airplane and type of

operation.

ATTACK STRATEGIES AND TECHNIQUES

While riding on the jump seat on more than 100 flights, I have observed many situations where crewmembers have developed their own innovative personal strategies and techniques to increase awareness. To name a couple:

1) A B-737 Captain told me he mentally prepares for a rejected takeoff by reviewing the procedure each time he taxies onto the runway. While this only takes a few seconds, it puts him in a readiness state should the risk occur.

2) A B-727 Second Officer not only checks that the ground interconnect switch is in the closed position, but also verifies that the "A" system pressure is zero before responding "closed" during the prestart checklist. This additional step provides awareness in the event of a mechanical failure.

The numerous ways that flight crews have found to enhance awareness is a tribute to their ingenuity and professionalism. The only problem with this individualistic approach is that some pilots may be unaware of the techniques and strategies of other pilots.

Flying used to be an individual activity but has evolved into a team endeavor over the last 20-30 years. The last remnants of the individual approach, however, can still be found in the strategies and techniques which appear to be largely left to the pilots to figure out for themselves. Since awareness is such an important factor in safety, consideration should be given to incorporating critical awareness strategies and techniques into training programs.

ENVIRONMENTAL SIGNALS

Despite the best intentions, things go wrong sometimes and therefore it is necessary to develop an awareness of the early indications of problems. The nuclear industry has found that many major accidents, like Three Mile Island, begin with small, seemingly insignificant situations which they call "small-break anomalies." By increasing crew awareness to these early indications of a potential problem, accidents can be avoided.

The specific aviation items which should be monitored must be determined by those within the profession. A good example of these early indications are the 13 "Red Flags" which were derived by United Airline's Safety Department from the "error chain" work by Doug Schwartz of FlightSafety International:

(1) Lack of terrain awareness
(2) Communication breakdown
(3) No one flying the aircraft
(4) Departure from standard operating procedures
(5) Erroneous assumption
(6) Fixation/preoccupation
(7) Ambiguity
(8) Confusion
(9) Unresolved discrepancy
(10) Failure to meet targets
(11) Lack of traffic vigilance
(12) Use of an undocumented procedure
(13) Physical/mental dysfunction

These red flags (environmental signals) should raise a crewmember's awareness to characteristics which have frequently been found in aviation accidents. I am told that four or five of these red flags have been present in some accidents. Red flags will not always be indicative of a problem. They should, however, cause concern and create the need to investigate.

The identified environmental signals should be as specific as possible to eliminate confusion and false alarms. I should think it would be worthwhile to identify specific environmental signals within different aircraft types, different types of operation, two/three-person crews, and glass/conventional instrumentation.

MONITORING INHIBITORS

No article on monitoring would be complete without mentioning distractions, stress, or fatigue. These three inhibitors are the natural enemy of effective monitoring and must be controlled. Fortunately, much work has been done in these areas and various techniques and strategies are available to manage distractions, stress, and fatigue. While these items are complex and cannot possibly be covered in this brief article, they can and should become an integral part of all Cockpit Resource Management (CRM) programs.

CONCLUSION

Active and focused monitoring requires significant commitment, conscious effort, and mental energy. The most important aspect in the process is to identify the right items to be monitored to reduce the crew work load and prevent sensory overload. As with all skills, however, practice through CRM training is necessary to acquire a working proficiency and develop an automatic response. This training must emphasize seeing as well as looking, listening as well as hearing, and selective perception.

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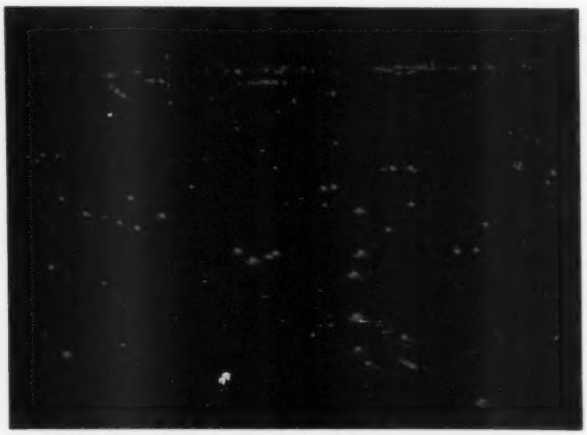
The Starlifter and SOLL II

Only a select few have "the right stuff."

By Maj. Stephen E. Behr
Associate Editor

How runway looks during planning using NVGs.



What the aircrew sees when looking for the runway.

Most Starlifter crews have experienced night missions, cruising for long hours across an ocean, monitoring the HF radio in a dimly lit cockpit. Airdrop qualified C-141 crews have seen night missions which include a low level route followed by an airdrop to a fairly well marked drop zone. For a very select few, the night is filled with the pale glow of blue-lighted cockpits and an eerie green and black vision of the world around them. They are Charleston's Special Operations Low Level (SOLL) II crews.

The 437th Military Airlift Wing at Charleston AFB, S.C., is home for MAC's C-141 SOLL II crew force. Generation of strategic special operations comprised part of the congressionally mandated improvement of special forces during the early 1980s. Their mission is to conduct long-range formation or single-ship intrusion of hostile territory, providing highly reliable, self-contained, precision airdrop or airland of personnel and equipment. Mission success is enhanced by minimum lighting, minimum communications, and preplanned avoidance of enemy threats, detection systems, and populated areas. SOLL II crews receive the same basic airdrop training as other MAC crewmembers; the big difference is their use of night vision goggles (NVG) for airdrops, offloads, landings, taxiing, and low level flying.

Their capabilities include conducting clandestine airdrops of personnel, supplies, and equipment into very small unmarked water and land drop zones at night during blacked-out conditions, possibly in adverse weather conditions. This requires a very highly motivated and skilled crew force. The members of a SOLL II crew are carefully selected volunteers from within the airdrop

crew force. Crewmembers must have extraordinary judgment, maturity, experience, dedication, and determination to get the mission accomplished.

The make-up of a SOLL II crew and crew position terminology is quite different from normal airland or airdrop operations. There are nine separate positions on a SOLL II crew. These are: Left Seat Pilot, Right Seat Pilot, Jump Seat Pilot, Radar Navigator, Map Navigator, Primary Engineer, Secondary Engineer, Primary Loadmaster, and Secondary Loadmaster.

The left seat pilot is the aircraft commander. Since SOLL II crews are integral crews, he is also crew commander and spokesman. For some exercise missions, he may act as the mission commander. The left seat pilot is responsible for making sure his crew is properly trained and scheduled. He is the only pilot on the crew trained and permitted to land and take off on night vision goggles. He is usually the most experienced of the three pilots. He must be an instructor pilot, lead airdrop, air refueling instructor pilot, and SOLL I aircraft commander (currently SOLL I is not being flown).

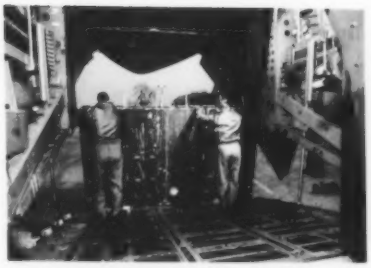
Capt. Sam Cox, 41 MAS, has qualifications typical of the folks who are left seat pilots. He is a flight examiner aircraft commander, air refueling flight examiner, and lead-CDS qualified pilot. He explained, "It takes time to achieve all the qualifications needed to move into the left seat. It's typical for a pilot starting in SOLL operations to spend one or two years as a jump seat pilot before moving into the right seat, then spend another year or so gaining the needed experience and qualifications to become a crew commander. Left seat pilots are at the pinnacle of possible pilot qualifications."

SOLL II pilot wearing ANVS-6 night vision devices.

The transition from airland into SOLL II, and upgrade to left seat pilot, involves 14 different flight evaluations according to the folks at the Special Operations Division, headed by Lt. Col. Tom Larned. His deputy, Lt. Col. William H. Conrad, explained that SOLL II pilots have over 100 currency events per year. Other crew positions have currency events similar in number.

The right seat pilot does most of the low-level flying, freeing the left seat pilot to concentrate on the overall mission. The right seat pilot usually flies the airborne radar approach (ARA) until about two miles out when the left seat pilot takes over and lands. Both left and right seat pilots wear NVGs during the entire mission. The right seat pilot must be an airdrop aircraft commander. He does not have to be instructor or lead-qualified.

The jump seat pilot is the safety observer. Since it's easy to get distracted during a SOLL II mission, the decision to place a safety observer in the jump seat seemed logical. His primary job is to watch the left and right seat pilots, and crosscheck everything they do. He pays particular attention to altitude (radar and barometeric) and airspeeds, and calls out any deviations. His secondary role is to assist the left and right seat pilots with a variety of tasks such as map reading, frequency changes, and operation of the INS/FSAS. He is often the least experienced of the pilots. He must be a first pilot and an airdrop copilot.



Loadmasters preparing full-width aux loading ramp for use.

The radar navigator sits at the navigator's station for the entire SOLL II mission. During the low-level route, he calls out landmarks and crosschecks course centerline with the INS. He is responsible for time control, a task which takes much of his time since tolerances are plus or minus 30 seconds maximum. Deviation at touchdown is usually less than ten seconds. He gives the pilots an ARA into the objective airfield. This is done using radar beacons placed on the airfield which are detectable with aircraft radar. The radar navigator's goal is to place the aircraft within plus or minus one-half mile of the extended runway centerline. He is the most experienced of the two navigators. Minimum qualification is instructor and lead-qualified. He does not wear NVGs during the mission.

The map navigator is seated on a small camp stool behind the copilot. He wears NVGs and confirms course centerline by looking outside and map reading. During the ARA, he moves to a position behind the radar navigator and calls out distance to go and recommended altitudes. The map navigator needs to be mission-qualified only.

Finding pilots and navigators

with the desired qualifications and experience is sometimes difficult. Col. Vernon C. Hansen, 437 MAW/ADO, explained. "The wing can recruit up to four pilots and navigators per year from other C-141 units. We have a very small group of folks here from which to select for the SOLL II program. Being able to recruit provides a broader experience base to select from. When we get a lead qualified AC, the time required to move that person into the left seat is a lot shorter. We look for IPs or FEs who are already airdrop qualified and ready for a real challenge in flying."

The primary engineer is an integral part of the crew. He performs basic engineer duties, runs the special checklists for SOLL II operations, and is interchangeable with the scanner, if needed. Although the left seat pilot is the final decision authority, most SOLL II primary engineers command enough respect and recognition of their expertise that what they say weighs heavily in the decision process. This gives them the unenviable job of advising "go" or "no-go" when a system failure may cause a mission cancellation. Their judgment must be exceptional to prevent a disaster or mission failure. The primary engineer must be aerial refueling and airdrop-qualified and an instructor. He does not wear NVGs while in the engineer seat.

The secondary engineer, called the scanner, performs basic engineer duties and relieves the primary engineer as necessary. As scanner, he works in the rear of the cargo compartment, assisting the loadmasters as necessary with the offload and onload. His specific job is to operate the ramp and cargo doors during on and offloads. He conducts these operations on NVGs and his timing must be precise to ensure rapid operations. He must be completely familiar with manual door and ramp operations. In addition, he must be aerial refueling and airdrop-qualified.

SOLL II flight engineers are responsible for configuring the aircraft for SOLL II operations. They supervise or actually install landing light filters, anti-collision light filters, and NVG compatible cockpit lights. Additionally, they distribute chem lights, NVGs with spare batteries, and survival equipment. They also open selected circuit breakers to prevent inadvertent activation of normal lighting.

The primary loadmaster is one of the five integral crewmembers. He conducts all types of operations while on NVGs. He works very closely with the user to orchestrate very rapid, yet safe, on and offloads. A full-width loading ramp helps to achieve ERO times faster than those at Airlift Rodeo. SOLL II loadmasters are familiar with many specialized loads. Some loads may only be carried by SOLL II loadmasters. The infrequent opportunity to work unusual loads may mean a loadmaster in upgrade training may wait a long time before being exposed to and signed off for certain loads. Being hampered by NVGs make it necessary to carefully practice offloads many times under an instructor's supervision before being certified. The primary loadmaster must be CDS-qualified and an instructor.

A secondary loadmaster performs the same duties as the primary loadmaster but isn't designated as integral to any certain crew. He is not usually as experienced as the primary loadmaster. He must be CDS-qualified but doesn't have to be an instructor.

With the large number of crewmembers, the flight deck is a very crowded place during a mission and close crew coordination is critical. A mission-planning session is conducted the day prior to a training mission. This session is devoted to detailed route study and establishing what training will be conducted. With the chart updating manual in hand, the navigators build a route with two sets of altitude minimums—one based on 500 feet above the highest obstacle within three miles of course centerline (for a VMC mission) and the other based on 1,000 feet above the highest obstacle within five miles (for IMC conditions). After building the route, the crew discusses the events which will occur during each phase of flight.

During a planning session I attended, a crew discussed crew coordination at length, based on scheduled training and the addition of non-integral crewmembers and observers. The left, right, and jump seat pilots coordinated airspeed calls during the ARA and for the rest of the landing sequence. This extensive crew coordination before a mission is one of the factors allowing SOLL II crews to maintain a margin of safety in a risk-filled environment.

Another factor critical to a successful mission is maintenance. When the crews deploy on exercise missions, they take some of the folks from "F-Troop," a small group of aircraft maintenance specialists. These highly motivated specialists are specifically trained to assist special operations crews and maintain equipment unique to special operations employment.

It takes a lot of dedication to be a SOLL II crewmember. As one crewmember stated, "It's very challenging—very satisfying. You get immediate feedback on how you do during a mission. You know that when your mission is complete you have indeed, 'delivered the sting'."

Flying-Hour Milestones

15,000

153 TAG
CMSgt. Ross R. Peery

10,000

6 MAS
SMSgt. Cleveland Croswell

89 MAW
SMSgt. Michael D. Lynn

437 MAW
CMSgt. Claude A. Irelan, II

7,500

8 MAS
Lt. Col. Gary N. Beson
CMSgt. Omar Salazar
SMSgt. Curtis D. Angell
SMSgt. Patrick A. Nolan

153 TAG
Lt. Col. Earle W. Stewart
SMSgt. Robert W. Williams
MSgt. Ronald R. Dausman

302 TAW/CC
Col. Robert J. Winner

5,000

4 MAS
Maj. Ronald D. Prynne
CMSgt. Bruce E. Brunkow
CMSgt. Leon S. Spaeth
SMSgt. Michael E. Brown
MSgt. Bernard A. Greene
MSgt. Dain C. Hansen
MSgt. Thomas B. Saucier
MSgt. Frederick W. Thompson
TSgt. James W. Fenton
TSgt. Benhard J. Nesheim
TSgt. David R. Peterson
TSgt. Ricky J. Smith
TSgt. Brian W. Summ
SSgt. Arthur L. Bunger
SSgt. Jeffrey A. Davis
SSgt. Richard A. Haughian
SSgt. John L. Manning
SSgt. Curtis E. Rickard
SSgt. Mitchell J. Warnick

6 MAS
TSgt. Jeff L. Daniel
TSgt. Dennis M. Petry

8 MAS
Lt. Col. John I. Keith
Maj. Danny W. Gugelman
Maj. Joseph J. Stiklickas
SMSgt. David A. Turner
MSgt. Donald J. Vinson
TSgt. Darrell J. Boyle
TSgt. Keith Windmeyer
TSgt. Frederick C. Hunt, Jr.
TSgt. Michael V. Keesler
TSgt. Donald L. Davenport
SSgt. Benito Arizmendez, Jr.
SSgt. Ronald D. Parks
SSgt. Jerry L. Johnson

11 AAS
Lt. Col. John M. Bierie
Maj. Billy W. Wren

38 ARS
SMSgt. Alan P. Gniot

89 MAW
Col. Edward M. Bullard/CC
Lt. Col. John C. Lovell
Maj. Donald L. Dobias, Jr.
Maj. Jeffrey W. Dunaway
Capt. Robert L. Weatherly
TSgt. John P. Hayden
TSgt. Neal R. Tiemann
SSgt. Brian A. Erard

153 TAG
Lt. Col. Howard G. Wissemann
Maj. Leonard C. Kearl
Maj. Michael G. Montgomery
Maj. Harold E. Reed

731 TAS
MSgt. Jerome L. Olson

911 TAG
Lt. Col. Paul W. Roth, Jr.

1375 FTS
Lt. Col. George J. Siracuse
Lt. Col. Ronald L. Fuccillo

Det 5, 1400 MAS
Capt. Mike L. Peters

2,500

4 MAS
Maj. Randall Baxter
Maj. John C. O'Neill
Maj. David R. Smith
Capt. Mark J. Abbott
Capt. Brock W. Eschleman
Capt. James E. Kimpel
Capt. Ralph T. Mead, Jr.
Capt. James L. Schneller
Capt. Kevin C. Smith
SMSgt. Larry J. Hanks
MSgt. Mario R. Almendarez
MSgt. Michael E. Engels
MSgt. Richard D. Moran
MSgt. Roberto A. Santos
MSgt. John T. Scott
TSgt. David M. Bambaloff
TSgt. Robert E. Byrd
TSgt. Bruce W. Ebert, Jr.
TSgt. Permal Naidu
SSgt. John C. Anderson
SSgt. Larry A. Hall
SSgt. Robert P. Johnson
SSgt. Robert A. Kroll
SSgt. James L. Morrison
SSgt. Timothy R. O'Donnell
SSgt. Cynthia J. Versley
Sgt. Daniel P. Talbot
Sgt. Kirt E. Thompson

8 MAS
Lt. Col. Robert J. Thorpe
Lt. Col. Julian D. Allen
Maj. Cameron E. Shackelford
Maj. Stanley L. Schoener
Maj. Mark S. Solo
Maj. James L. Urion
Capt. Karl H. Becker
Capt. Anthony M. Butters
Capt. Michael D. Cassidy
Capt. Daniel S. Lampkin
Capt. Buford D. Lary, Jr.
Capt. Scot H. Loizeaux
Capt. Randall L. Long
Capt. John A. McLaughlin, Jr.
Capt. Johnny M. Morris
Capt. Bobby G. Neale
Capt. Paul D. Olmstead
Capt. Mark B. Ott
Capt. Oscar J. Padeway
Capt. Mark L. Sime
Capt. Arthur M. Shirai
Capt. Perry X. Weston
Capt. George J. Wiggins, Jr.
MSgt. Robert A. Clow
TSgt. Robert C. Budlong
TSgt. James H. Burks
SSgt. Charles D. Brown
SSgt. Leon D. Harper
SSgt. Charles R. Lauderdale
SSgt. Richard J. Kienzle
SSgt. Randy M. Niarhos
SSgt. Michael G. Skalisky
SSgt. Stephen J. Ullman
SSgt. Russell D. Van Winkle
SSgt. Paul M. Wagener
Sgt. Shawn E. Brumfield

53 WRS
MSgt. Robert S. Bruhl

WESTPAC RCC
Lt. Col. Thomas Janke
Maj. Erwin A. Belorvsky, Jr.

153 TAG
Maj. Dennis C. Cook
Capt. Giles D. Harlow
Capt. William B. Wright
TSgt. Barry K. Arnold
TSgt. Michael A. Sorensen
SSgt. David J. Herzfeld
SSgt. James P. Moffett

302 TAW
Maj. Frederick W. Brown
Maj. Roger A. McFarland

443 MAW
Col. William Welser, III.

731 TAS
Maj. Arthur J. Farrington
Maj. Dennis R. Forinash
Maj. Lawrence J. Ross
Maj. Robert G. Wenger
Capt. James M. Dugan
Capt. Timothy L. Rorick
Capt. Randy G. Rothe
Capt. Wayne C. Shackleton
MSgt. David D. Carey
MSgt. Marshall H. Hopkins
MSgt. Charles R. Lenahan
TSgt. John T. Cusack, Jr.
TSgt. James D. Riley

911 TAG
TSgt. Wayne T. Barna
TSgt. Robert J. Leap

1,000

Det 9, 37 ARS
Capt. Kent R. Gibbons
Capt. S. T. Sullivan

Ranks and units are those at time of award.

HELICOPTER OPERATIONS IN A MICROBURST ENVIRONMENT

By Lt. Col. Eugene E. Mace
U. S. Army

Microburst wind shear (MBWS) is hazardous to helicopters for basically the same reasons it's hazardous to fixed-wing aircraft. They are both affected by a systematic loss of lift when aircraft encounter downdrafts and tailwind conditions undetected by the crew until the aircraft has penetrated the wind shear. The majority of MBWS can be dealt with at altitude (above 1,000 feet); however, encounters below 500 feet above ground level (AGL) can pose a significant hazard to all aircraft, including helicopters.

Admittedly, no documented research has been conducted dealing specifically with helicopters and MBWS. However, a report by the Committee on Low Altitude Wind Shear and Its Hazard to Aviation, stated, "Wind shear represents a hazard to all aircraft, ranging from small general aviation aircraft to swept wing jet transports."

In one incident, a helicopter in cruise flight at 1,200 feet encountered a localized heavy rainshower. The aircraft quickly lost 600 feet of altitude although the crew held maximum continuous power. The loss of altitude was attributed to the rapidly flowing column of air from a descending microburst. Although this crew had sufficient altitude to arrest the helicopter's descent, this may not have been true had it been engaged in terrain following flight.

Though the effects of microbursts on helicopters are not identical to those of fixed-wing aircraft, they are similar since both move airfoils through the atmosphere to create lift, and both have the same three axes of motion (pitch, roll, and yaw). The most critical aspect of loss of lift situations involving fixed-wing aircraft is a sudden degradation of airspeed corresponding to a drastic loss of lift and altitude. Any decrease in airspeed, such as that experienced in a sudden tailwind condition, results in a corresponding loss of lift if all other values remain constant. Helicopters are similarly affected by tailwinds, especially if they are at or near their power limit. In addition to the loss of lift accompanying the tailwind condition, the downflow in the center of the microburst also contributes to the overall loss of lift. This occurs since, as the aircraft enters the downflow, it pitches over, decreasing the angle of attack.

Effects on Fixed-Wing Aircraft

The following step-by-step discussion of an airplane penetrating a microburst on final approach and immediately after takeoff helps explain exactly what happens and why. It also provides a basis for understanding how the same principles apply to a helicopter under the same conditions.

Encounter on final approach (Figure 1). As the airplane approaches the initial outflow of the microburst, an uncommanded increase in airspeed and angle of attack initially causes the plane to pitch up and climb (a). In response, the pilot reduces power and angle of attack to remain on his approach path. Descent rates are aggravated as the airplane encounters the downdraft portion of the microburst, which further reduces angle of attack and increases descent rate (b). As the aircraft encounters the tailwind outflow segment, which again decreases the angle of attack and effectively

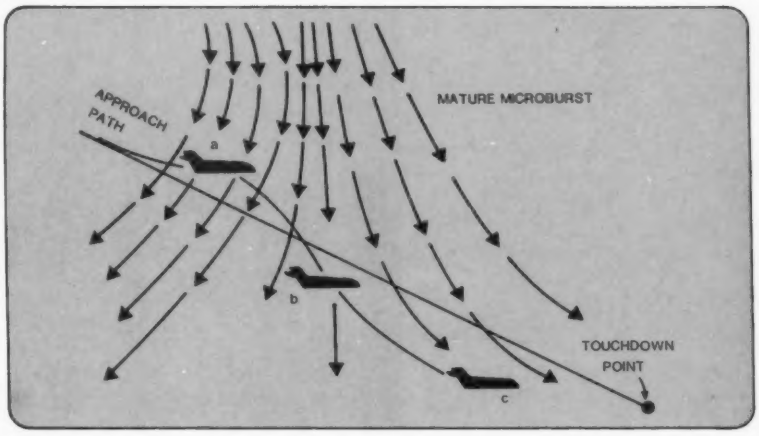


Figure 1: Microburst encounter by fixed-wing aircraft during final approach.

reduces indicated airspeed (IAS), we see a further reduction in lift (c). At this point, depending on altitude, the only hope for recovery is to add maximum power and increase the angle of attack to a maximum lift condition. Unfortunately, a common mistake made by pilots at (c) is to lower the nose of the aircraft to regain reference airspeed. This may, depending on altitude, make recovery impossible.

Encounter immediately after takeoff (Figure 2). Immediately after takeoff, an airplane's power and angle of attack are much closer to maximum limits than in the previous situation. For this reason, a severe microburst may be more than the airplane can overcome, as was the case of the Boeing 727 at New Orleans in 1982. In the following situation, the airplane takes off and encounters the downburst segment of the microburst (a). As in the previous example, the airplane loses lift because of a decreased angle of attack. This is followed by a further reduction of lift due to a loss of airspeed as the aircraft passes through the center of the microburst into the tailwind outflow segment (b). Depending on the actual altitude at which the airplane encounters the microburst and the height of terrain and obstacles, the pilot's only chance for recovery rests with an immediate recognition of the problem at or before (a). This was portrayed graphically in the New Orleans accident when the B-727 encountered the shear at 163 feet about six seconds after takeoff. In a matter of seconds, the B-727 lost 110 feet of altitude and airspeed decreased from a maximum of 162 knots 47 seconds after takeoff to 144 knots 54 seconds after takeoff. Although the B-727 was climbing at approximately 361 feet per minute when it first impacted a 52-foot tree, it was descending at more than 1,200 feet per minute five seconds before the first impact. In his investigation of the accident, Dr. T. Fujita, Department of Geophysical Sciences, University of Chicago, determined that "the loss of altitude inside the microburst was attributed two-thirds to the tailwind and one-third to the downflow."

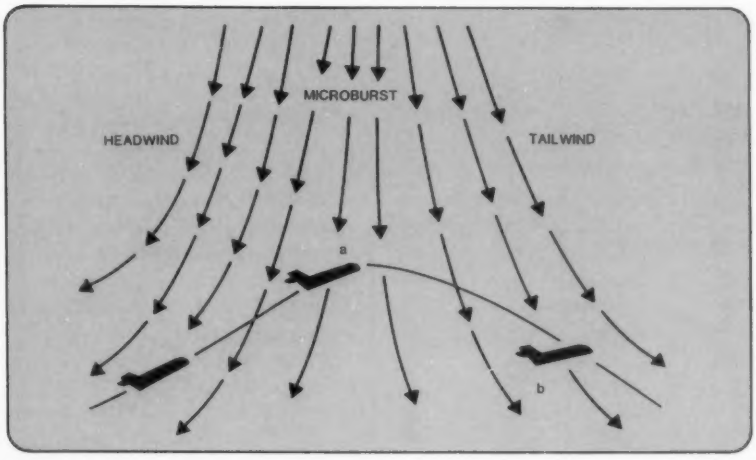


Figure 2: Microburst encounter by fixed-wing aircraft immediately after takeoff.

Effects on Rotary-Wing Aircraft

In either of the two conditions, a helicopter is affected in a similar manner because the same basic aerodynamic principles apply. What is not known is to what degree the same microburst would have affected a helicopter.

Comparing the effects of microburst wind shear on two different categories of aircraft, the following factors, as a minimum, should be considered.

Stability. In the case of nonstability equipped airplanes and helicopters, the airplane would be minimally affected by microburst conditions due to inherent stability. However, many modern helicopters are equipped with stability-augmented systems capable of providing artificial dynamic stability. These systems, along with built-in design factors, reduce helicopter crew work loads to about the same as those experienced by airplane pilots. For this reason, microburst conditions would have almost the same effect on both categories of aircraft.

Power application response time. Some airplanes, particularly those powered by jet engines, have an apparent lag time from throttle movement to engine response. In the case of a microburst encounter at traffic pattern altitudes, this lag time may be critical. Helicopters, on the other hand, are operated at full throttle (governor controlled) throughout the normal flight envelope with power linked directly to the rotor blades (angle of attack). In other words, when a helicopter pilot adds or decreases collective pitch to change the rotor blades' angle of attack, the engine power (torque) is reset at the same time. In most situations, power applications up to maximum limits cause no perceivable engine droop, and response is almost instantaneous with collective movement. As a result, the helicopter, with all other conditions equal, would seem to have an advantage over fixed-wing aircraft.

Stall characteristics. The helicopter, by virtue of its whirling

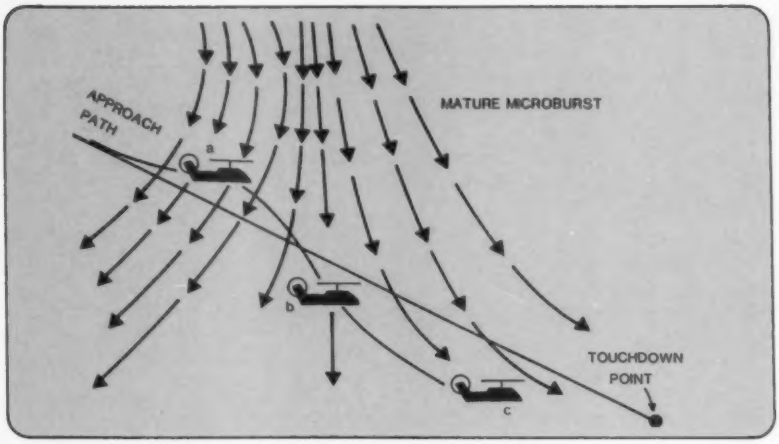


Figure 3: Microburst encounter by helicopter during final approach.

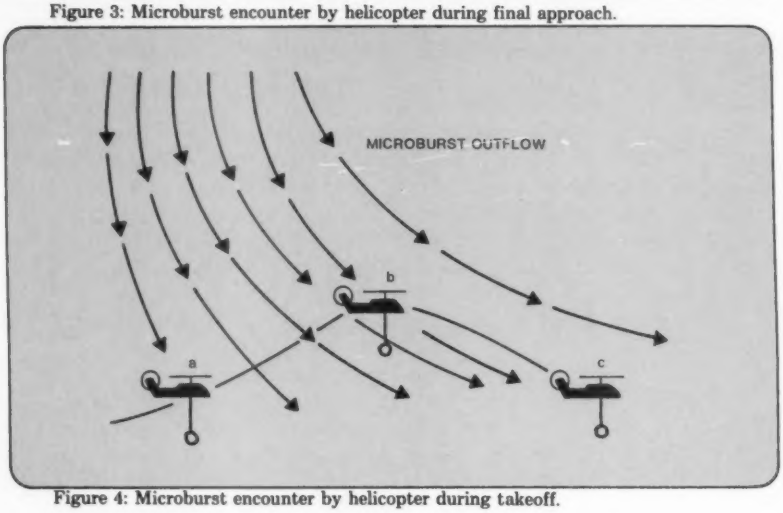


Figure 4: Microburst encounter by helicopter during takeoff.

rotor blades (which are maintained at a constant velocity by a governor), is capable of reducing its forward speed to zero without stalling. This ability to vary airspeed across a much wider spectrum enables a helicopter to convert airspeed to altitude, to a larger degree than an airplane, without risking a stall. This capability gives the helicopter pilot greater flexibility when faced with an inadvertent microburst encounter.

Typical mission profiles. A unique characteristic of the helicopter is its ability to hover; and the hover mission is the mainstay of helicopter operations. Typical hover missions include terrain flight (including nap of the earth (NOE)), pinnacle and confined-area operations, sling loads, and various rescue missions. Since most of these missions occur at relatively low altitudes (below 200 feet AGL), and in close proximity to terrain and obstacles, microburst encounters are extremely critical. In addition to reduced reaction times due to low altitude, available engine power is also a problem. A helicopter operating at a hover or below effective translational lift (ETL) is operating much closer to its maximum allowable power limits. Therefore, it has less of a margin of power to allow it to fly out of critical conditions. One other factor which could impact helicopter missions to a greater degree than many airplane missions is the remoteness of areas from which helicopters typically operate. These areas are usually devoid of modern pilot aids such as radar, wind shear indicators, or even weather observations.

The following are recommended pilot response actions for three types of microburst encounters:

Situation 1—Encounter on final approach (Figure 3). This situation involves a helicopter on final approach. The microburst is located one half mile from the approach end of the runway and is centered along the approach path. As the helicopter proceeds on final, the initial phases of the approach are normal. The first indication of an impending problem occurs when the helicopter enters heavy rain at about 400 feet. The initial outburst winds of 24 to 30 knots will cause the nose to pitch up, accompanied by a corresponding increase in IAS. The established descent rate for holding the glide path will either decrease, or the helicopter will actually begin climbing (a). At this point, without prior warning of microbursts in the area or without a Doppler radar warning from the ground, it would be highly improbable that any pilot would be able to correctly determine the onset of the initial stages of microburst penetration. Normal pilot responses would consist of a power reduction and reestablished pitch attitude to regain the approach airspeed and glide path. As the helicopter approaches 300 feet, it passes through the initial outburst and enters the core of the downflowing microburst (b). This would be perceived by the pilot as a noticeable

sinking sensation, with a corresponding descent indication on the vertical speed indicator (VSI). An apparent pitch-over would also occur as the helicopter entered the downflow segment. Once the helicopter passed through the core of the microburst into the tailwind outflow (c), the IAS would drop, further aggravating the descent and making recovery exceedingly difficult. The combined negative lift effects produced by the downflow and tailwinds are sometimes too much to overcome. For example, in a real-life case, a Boeing 727 was unable to overcome a sudden headwind-to-tailwind condition that reduced its IAS by 16 knots in seven seconds. This was combined with a 22-foot-per-minute downdraft, which caused it to crash 2,400 feet short of the runway. In another instance, a Lockheed L-1011 initiated a missed approach at 400 feet as a result of the same microburst conditions. The L-1011 descended to within 60 feet of the ground before it began climbing. For these reasons, it is imperative that the microburst conditions (sudden increases or decreases in airspeed with corresponding changes in performance) be recognized as early in the approach as possible so that a timely recovery (missed approach) can be initiated. The recovery should consist of maximum power at best rate-of-climb attitude until clear of downburst conditions.

Situation 2—Encounter immediately after takeoff (Figure 4). This situation involves a helicopter performing a slingload mission. The takeoff (a) is made in visual flight rules conditions. At about 100 feet, the helicopter encounters rain, which necessitates the use of the windshield wipers (b), but the aircraft does not enter instrument meteorological conditions. The IAS suddenly drops from 80 to 40 knots in about five seconds and is accompanied by a noticeable sinking sensation, with a corresponding descent on the VSI/VVI (c). Concerned with loss of airspeed, the normal pilot response is to lower the nose to regain the lost airspeed. As in the first situation, the recommended pilot response is to apply maximum power and set the pitch attitude on maximum climb attitude, regardless of IAS. In the case of flight-director-equipped helicopters, the go-around mode would be invaluable since it could be selected for immediate pitch attitude reference. If the descent cannot be arrested, the load should be jettisoned without hesitation. In this situation, the normal headwind and to some degree the downburst portion of the microburst was not a factor since the microburst occurred adjacent to the takeoff point rather than directly in line with the flight path.

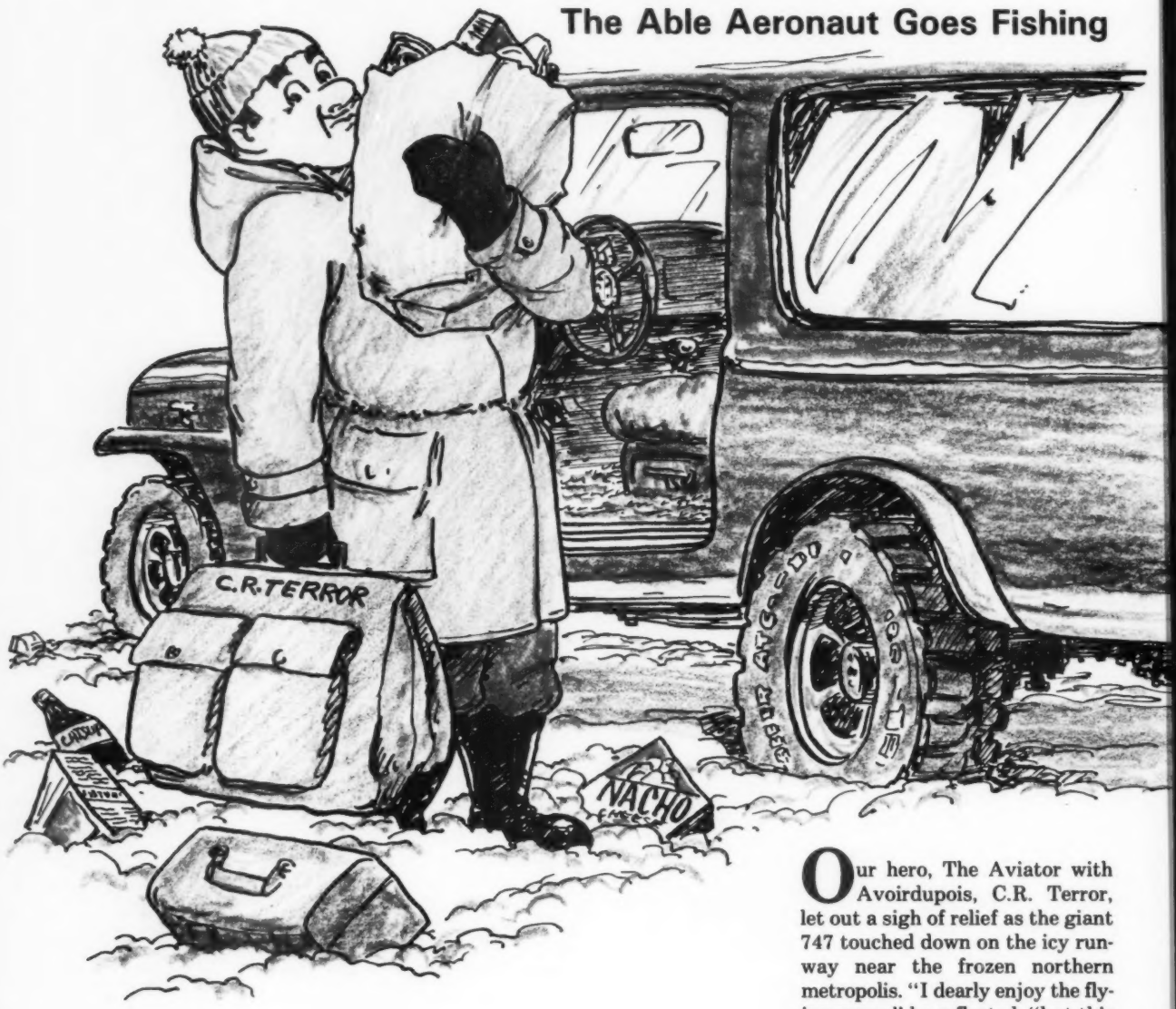
Situation 3—Encounter during nap of the earth (NOE) flight. This situation involves a helicopter engaged in NOE flight. As stated previously, the effects of a microburst on a hovering helicopter are potentially more severe than if the helicopter were in forward flight above ETL. The first indication of the impending microburst is a dust cloud about one mile to the front. This is followed immediately by a gusty disturbance in the trees/brush surrounding the helicopter. During the initial outburst portion of the microburst, the helicopter will derive increased lift because of greater efficiency of the rotor system interacting with outburst winds. The hovering helicopters's IAS will increase in response to the outflow and, depending on the magnitude of the microburst, may pass throught ETL while at a hover. This will necessitate a substantial power reduction to maintain a constant altitude and may not be a problem unless the helicopter's flight path continues through the remainder of the microburst. The safest maneuver at this point is to land and remain at operating rpm until the disturbance ceases. If a landing cannot be made due to terrain, an abrupt course change may avoid the core of the microburst. The pilot should take care not to expose the helicopter to critical wind azimuths, especially below ETL. The least desirable action would be to attempt to climb out through or along a path parallel to the microburst. This action would expose the helicopter to the full intensity of the wind shear.

Although the preceding is highly speculative, it attempts to describe probable sequences of events with different microburst encounters. In all three situations, early microburst detection is important for successful penetration or avoidance. Aircrews should be especially alert for danger signals that may provide clues to a microburst encounter. Once microburst contact is suspected, whether on final or during takeoff, maximum power should be applied along with a change in pitch attitude which provides best rate of climb. In the hover situation, flight through or near the center of a microburst would, in all likelihood, be extremely difficult to cope with due to the relatively close proximity of the terrain. As in the other two situations, early recognition of microburst danger signals increases the pilot's odds of coping with the wind shear or successfully avoiding it. If a microburst is contacted during a hover, every effort should be made to land. If a landing is not possible, the center of the microburst should be identified and avoided. No attempt should be made to climb through the center of the microburst.

Courtesy of *U. S. Army Aviation Digest*

C.R. TERROR

The Able Aeronaut Goes Fishing



Our hero, The Aviator with Avoirdupois, C.R. Terror, let out a sigh of relief as the giant 747 touched down on the icy runway near the frozen northern metropolis. "I dearly enjoy the flying game," he reflected, "but this backseat driving sets my nerves on edge. I wonder if my hero, Joe Montana, feels the same way when his wife drives? We pilots are a lot like race-car drivers. Guess I'll have to ask him after he wins the World Series."

Despite the rigors of his recent flying schedule, the time had finally come for the Rhinestone Flyboy to take some well-deserved leave. He had flown out his allotted time for the month, shuttling back and forth from the desert. Much to his boss, Col. Fang's, pleasure C.R. had been relegated to the northern tier, out of harm's way. Colonel Fang failed to mention, however, that he too was planning a little time off for some late-winter snowmobiling. Little did the pair realize how soon their paths would cross.

C.R.'s plan was to get away from it all for a while, do some ice fishing at his secluded cabin on Bikini Lake before the ice melted, and basically, relax. Hand-tooled baby-blue B-4 bag, fishing tackle, and assorted consumables in hand, the Great One headed for the car rental desk. Much to his chagrin, there were no E-type Jaguars to be had, so the Maestro of MAC Machines was forced to secure the services of a lesser means of transportation. As he pulled from the parking lot in the shiny new 4x4, his spirits were lifted somewhat with the realization he could now drive out on the ice to his favorite fishing hole rather than walk.

The trip to Bikini Lake took just over four hours. Ice-covered roads made driving sporty, but in typical Terror fashion, conflicting traffic didn't have a chance. The Master Manipulator pulled up to his cabin shortly before sunset, leaving a trail of snow-bound vehicles in his wake. By the time fishing tackle, baggage, groceries, etc., were offloaded, and a substantial quantity of vittles consumed, it was time for the Omnipotent One to hit the sack in preparation for an early rise.

The following morning dawned bright and clear. It was obvious to the Great One the northern tier had experienced some warming days early in the season as the ice on the lake seemed to take on a dark hue in spots. Not to be deterred, however, he loaded the 4x4 with supplies, and the portable ice-fishing house he had stored in the cabin, and headed for his favorite spot in the middle of the lake. The vehicle left deep ruts as it mushed through the thin crust of snow. The Magic Major's first indication of trouble was when he stepped out of his machine near the center of the lake and sunk up to his knees in slush.

"Gadzooks," he yelped, "The ice sure is soft this year. Ah well, just that much less to chop through to get to those delicious walleyes."

Setting up the portable shelter proved interesting, what with the usual lack of coordinated effort and forethought typical of our Ambient Aeronaut. C.R. was again surprised when his chrome-plated ice chisel dove to the bottom of the lake after the third chop. He appeared to have less than four inches of ice beneath his feet. Terror struck Terror, when he remembered the shiny new 4x4 parked just outside. His worst fear became reality as he opened the door of the shelter just in time to see the antennae of the vehicle slip beneath the surface of the hole in the ice which had engulfed his ride home. To make matters worse, the sinking of the vehicle had started a chain-reaction in the ice, and cracks were beginning to appear everywhere. The Paunchus Pilot froze with fear as a huge crack emerged from nowhere and headed straight toward him. The die was cast as the crevice passed between his feet and widened just enough to engulf C.R.'s temporary home, the portable shelter, directly behind him. He could only reflect on how utterly foolish he had been to drive out on the ice this time of year without checking it first, as his knees buckled and he plunged into the icy water.

How long he was in the frigid water, he did not know. All he did know was his entire life passed before his eyes in that short time—the short list of good and long list of bad decisions he had made in his career. From out of nowhere, the hand of fate intervened. As the Field-grade Fumbler was about to go down for the last time, he was grabbed by the collar and hoisted

from the jaws of death. As he looked up, he couldn't believe his eyes. He was sure he had met his end and would now, for all eternity, pay for his previous shortfalls. There, clad in a red snowmobile suit, topped off by a red stocking cap which the Flatulent Fibber was sure bore the distinctive horns of the Evil One himself, was Colonel Fang.

C.R. awoke with a start a short time later and found himself in the comfort of his own cabin, covered with blankets, thawing to the warmth of a roaring fire.

"Sometimes, Terror, I think if you had half a brain, you'd take it out and play with it," thundered the colonel. "What were you thinking, driving out on the ice like that? Don't you know they've had warm weather up here and that ice is as rotten as three-week-old swiss cheese? I oughta drown you myself!"

"I guess I just wasn't thinking, boss," whined the Ace of Alibis.

"Now, that's an understatement," muttered Colonel Fang as he slouched in the overstuffed chair opposite C.R. "Had I not been riding by on my snowmobile and watched that 4x4 dive for Davy Jones' locker, you'd be fish food. Common sense, Terror—all it takes is common sense—just like flying. I'm not at all surprised at your lack of it, since you've never shown much of it in the past, but this stunt takes the cake. Your complacency out on that lake could have cost you your life there, just as easily as it could in an airplane. We've all been through a lot in recent months, but now is not the time to let down our guard. As spring gets closer, we tend to let the good weather lull us into a false sense of security—things get easier. We tend to relax things like checklists, preflights, and our concentration. As you saw today, that can be fatal."

C.R. shuddered as he pondered the possible consequences of his actions. "You know," he mumbled through half-frozen lips, "I really thought I was a goner. Under the water, my entire miserable life passed before my eyes. I know it's a little late for New Year's resolutions, but I'm going to do better. I'll . . . ."

"Now hold on, Terror," barked Colonel Fang. "Don't make promises you can't keep. You've got to overcome years of practice in doing things the wrong way. All I want you to do when we get back to work is clean up your act and concentrate on the job at hand. Start setting a better example for people you fly with. Like I said before, spring and summer are just around the corner. We've all had cabin fever for one reason or another, and you seem to have let the long winter atrophy your senses. This is not the time to let complacency dull common sense and alertness—not in our business."

"I see what you mean, sir," stammered the Able Aeronaut. "I will do my best, you'll see. I'll stay on top of things and make sure the rest of my crew does too."

"That's better, Terror,"

boomed his chief. "Well, I better start heading back toward town. By the way, are you thawed out yet?"

"Oh, you bet," chirped the Bibulous Buffon. "I don't think I'll do any more ice fishing for a while but I'll survive. I forgot to thank you for pulling my hide out of the drink."

"No sweat, Major." A move I'll no doubt regret at some point in the future, thought Colonel Fang.

"Yeeooww," yelped C. R. "I almost forgot about the 4x4. That thing is going to cost me a mint to replace, and how am I going to get back to the airport?"

"Well, Major, as I see it, you've got two options. I could send a car for you from the town up the road, or you could hop on the back of my super turbo-charged, snow jet. Your choice."

"With all due respect, sir, I'd rather sit out the rest of the winter right here in front of this fire." One look at his boss reminded the Omnipotent One of their conversation. "I'll be ready when the car gets here, sir. We've still got a lot of work to do, don't we?"

"That we do, Major Terror," replied Colonel Fang with a sudden somber look on his face. "That we do."

QUICKSTOPPERS

JUST ENOUGH OIL

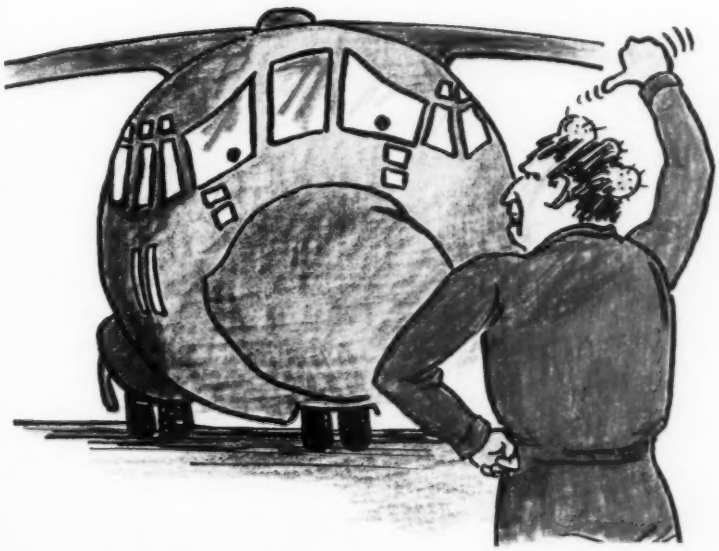
Start, taxi, takeoff, and climbout for this Cessna pilot were uneventful. En route at 8,500 feet MSL, he noticed the oil pressure had gone from the middle of the "green arc" to just below the arc. Both cylinder head and oil temperature were normal. According to the operator's manual, the problem could either be a gauge malfunction or a slow oil leak. The pilot decided to alter his route of flight, land, and check out the problem at an Air Force installation with an aero club. About 40 miles out, the pressure began a steady drop toward zero and, at the 25-mile point, the pressure reached zero. The pilot declared an emergency, maintained altitude, and proceeded direct to the base.

About 20 miles from the base, the engine began to run rough so he began a descent. Passing 5,000 feet MSL, the pilot felt he would not have enough power/glide distance to reach the base should the engine seize, so he informed the controller who pointed out a civil field five miles off the nose of the aircraft. The pilot lowered gear and flaps IAW standard operating procedures and executed an uneventful power-off landing. During rollout, with power at idle, the engine stopped running. Subsequent investigation revealed a leak from the Number Two rocker return line depleting the oil level to a point where only 1.5 quarts were left in the system after landing. Interestingly, the aircraft had just completed a required 100-hour inspection. No one knew, however, if oil line chaffing was present prior to the inspection. Safety folks recommended the aero club manager review procedures used during the 100-hour inspection.

SAY CHEESE!

While returning to home station following a local air refueling mission, a C-141 unknowingly presented a "photo opportunity" to a nearby Piper Cherokee. The Starlizard overshot the turn to final which resulted in ATC giving the transiting Piper a climb clearance. The Cherokee pilot started his climb but decided to maintain a rate that would allow his passengers an opportunity to photograph the C-141 at close range. Before the encounter was over, the Piper passed overhead and to the left of the C-141 by 300 feet. Is this what "See-and-Avoid" means?

BUMPS AND BRUISES



Following a successful airdrop, the loadmaster of the formation's Number 2 C-130 headed aft to retrieve the static line. Before he could complete his task, the aircraft encountered wake turbulance from lead and rolled slightly right. This roll was corrected with a rapid recovery to the left. The maneuver caused the loadmaster to take off on a short flight of his own which ended when he crash-landed next to the left paratroop door. The resulting injuries were limited to bumps, bruises, and abrasions, and he was able to return to work the next day. Sometimes those in front forget that not everyone is always secured by a seat belt.

Helo Hydraulics

As the MH-60G was about to begin a base overflight, inspecting flood damage, heavy rain showers moved in. The aircraft commander decided to land and wait for the rain to decrease before completing the survey. On short final, during a left turn, the Number 2 hydraulic pump reservoir low caution light illuminated. It was quickly followed by the Sability Augmentation System (SAS) off and boost off and caution lights. Aircraft heading yawed right 10 degrees before the pilot regained control. Collective began to drive up but was caught by the pilot. With aircraft control regained, he landed on the nearest taxiway and shut down without further incident. Inspection found water on and around all components under the forward sliding cowling. Moisture in the Number 2 hydraulic pump level switch cannon plug was suspected of causing a short circuit turning on the Number 2 "RES LOW" caution light. When that light is on, the pilot loses collective boost, SAS, pitch trim, and yaw boost. After drying the cannon plug and replacing a very damp SAS/FPS computer, the Blackhawk was back in business. A little rain in the wrong place can really be a handful.

After Deadlines

MAC PILOT CROSSFLOW BOARD SCHEDULED FOR APRIL - This program provides pilots an opportunity to crossflow between strategic and tactical airlift to develop a broader understanding of both missions. Selectees will report to their new units in fiscal year 1992. The program provides a crossflow of 10 strategic and 10 tactical pilots. To be eligible, pilots must be captains or majors, have extensive experience in their respective aircraft, and be instructor qualified. They must have at least three years time-on-station by September or be in a mandatory move status. Majors must have a date of rank of 1989 or later. Your local CBPO has details of the nomination procedures or contact Hq MAC/DPROA, Maj. Kip Self, DSN 576-4874. (MNS)

CRAF STAGE II ACTIVATED - With the onset of Operation DESERT STORM on 16 January, the Secretary of Defense declared an airlift emergency, authorizing MAC to implement Stage II of the Civil Reserve Air Fleet agreement. Under CRAF Stage II, commercial air carriers in the fleet are required to provide up to 181 aircraft to satisfy airlift needs. CRAF Stage I was activated by Gen. H. T. Johnson, CINCMAC, for the first time in its 38-year history on 17 August 1990. Since then, CRAF aircraft have flown more than 1,950 missions in support of Operation DESERT SHIELD. (MNS)

***THE NAVIGATOR* MAGAZINE RETURNS** - A commemorative edition of *THE NAVIGATOR* celebrates 50 years of Air Force Navigators. Its articles and illustrations take you from the first Nav school to the new complex at Beale AFB, Calif.; from B-24s over North Africa to AC-130s over Panama. It's coming soon to a flying squadron near you, or send for a copy. Also welcome are your donations to the Silver Wings Museum--a lasting monument to navigators at Mather AFB, Calif. Contact: *THE NAVIGATOR* Magazine, c/o Silver Wings Museum, Mather AFB, CA 95655.

DESERT STORM STRATEGIC AIRLIFT - Totaling more than 11,800 missions, more than 429,000 passengers, and more than 408,000 tons of cargo as of 28 JAN 91.

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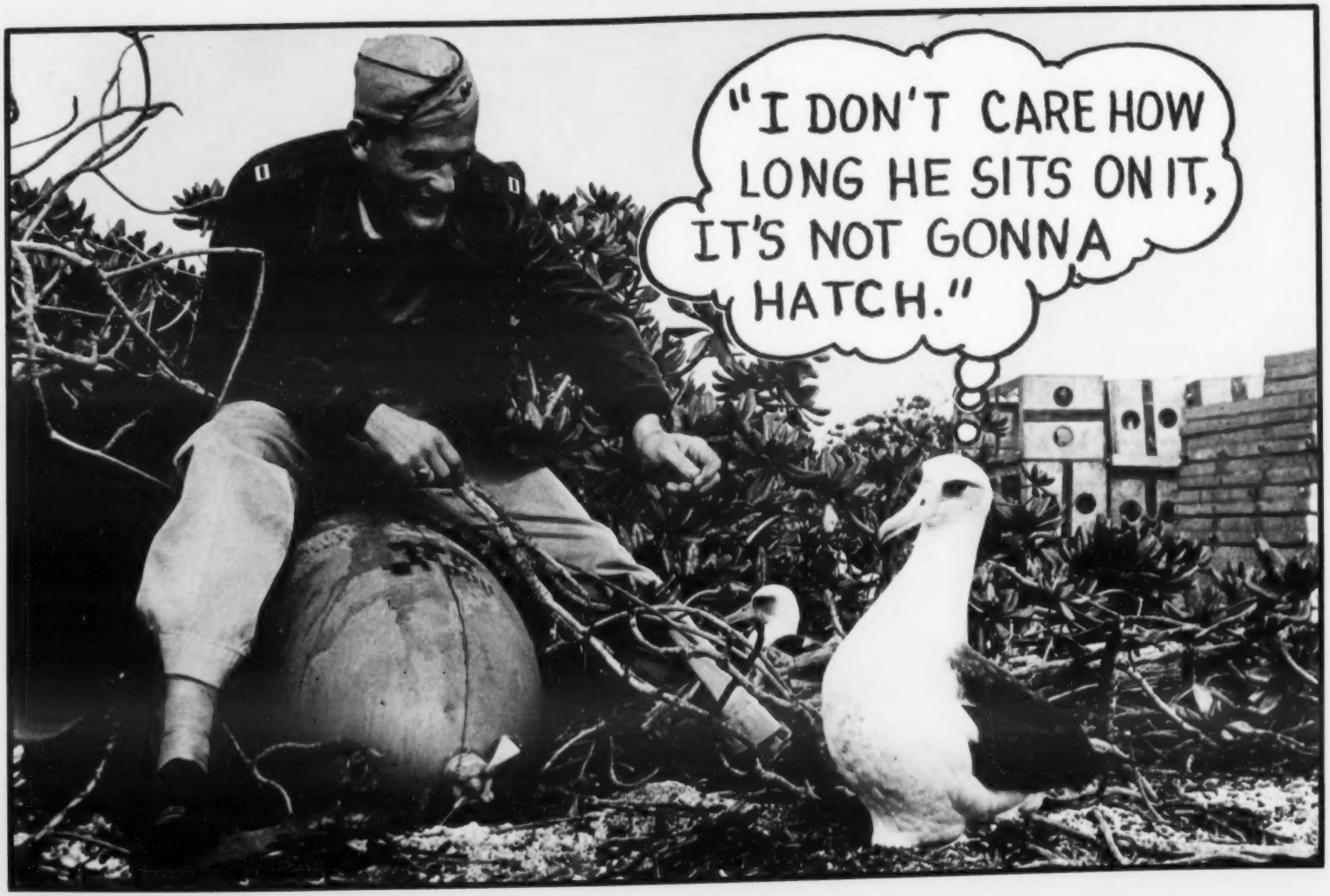
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